

DW Module 23:
Organic Removal
Answer Key



EXERCISE UNIT 1:

Use the Word Box above to complete questions. Words used twice are indicated with a (2).

Word Box

Air Stripping (2)	Adsorption (2)	Boiling	Carbon
Direct Filtration	Hydrogen	Ion Exchange	Molecular Size
Molecular Weight	Nitrogen	Oxidation & Adsorption	Oxygen
Polarity	Precipitation & Filtration	Reverse Osmosis	Source Control (2)
Volatility			

1. List the four basic elements in organic chemicals in the space provided.

Ans: Carbon
Hydrogen
Oxygen
Nitrogen

2. Write the names of the four properties of organics that affect their ability to be treated.

Ans: Molecular Size
Molecular Weight
Polarity
Volatility

3. List methods that can be used to remove organics from the water.

Ans: (In any order)
Source Control
Air Stripping
Adsorption
Precipitation and Filtration
Direct Filtration
Combination of Oxidation and Adsorption
Reverse Osmosis
Ion Exchange
Boiling

4. Name the three key methods of control and treatment.

Ans: Source Control
Air Stripping
Adsorption



UNIT 2 EXERCISE: 15 minutes

1. Source Control of organics involves two facets. Circle the statement that is correct.
- Minimize the level of organics in the influent and control the formation of toxic inorganics during treatment and distribution.
 - Minimize the level of organics in the effluent and control the formation of toxic organics during treatment.
 - Minimize the level of organics in the influent and control the formation of toxic organics during treatment and distribution.
 - Maximize the level of organics in the influent and control the formation of organics in the effluent.

Ans: C. Minimize the level of organics in the influent and control the formation of toxic organics during treatment and distribution.

2. Which two of the water quality parameters and testing performed (below) are not commonly done at the plant but by an outside laboratory?

Total Organic Carbon (TOC)	Dissolved Organic Carbon (DOC)
Ultraviolet 254	Specific Ultraviolet Absorbance (SUVA)
Algae Counts	Analysis for Synthetic Organic Chemicals (SOCs)
Turbidity	pH – Algal Activity
True Color	Apparent Color
Volatile Organic Compounds (VOCs)	

Ans: Analysis for Synthetic Organic Chemicals (SOCs) and Volatile Organic Compounds (VOCs)

3. Which state is not correct about predicting changes?
- Storm events will wash degraded organic materials into the surface water sources.
 - Warm weather followed by a cold snap may kill algae, resulting in degradation products that cause taste and odor.
 - Releases for dams or reservoirs will not change water quality.
 - Industrial activities may add to TOC, SOC or VOC to raw water.

Ans: C. Releases for dams or reservoirs may change water quality.

4. Reduction of natural organic matter in the treatment plant's raw water can occur in one of two ways. What are they?
- Remove the natural organic matter from the water before it enters the treatment plant.
 - Select a water source with less organic matter in it.
 - Natural organic matter can only be removed in the treatment process so selection is not a viable option.
 - Ground water sources are very high in natural organic matter and should be avoided.

Ans: A & B Remove the natural organic matter from the water before it enters the treatment plant and Select a water source with less organic matter in it.

5. Destratification, Algaecide and Multiple Sources are three or the four methods used to reduce the concentration of naturally occurring organics. Which is the fourth?
- Oxidization
 - Chlorination
 - Intake Placement
 - Mixing

Ans: C. Intake Placement

6. Which disinfectant(s) that can be used as an alternative to chlorine? Circle best answer.
- Ozone and Ultraviolet (UV) radiation
 - Chloramines and Chlorine dioxide
 - Both a. and b.
 - None of the above

Ans: C. Both a. and b.

7. Industrial, wastewater treatment and non-point sources are three major sources in which contaminants originate. Which statement is correct?
- SOC discharges from an industry may remain in the groundwater source long after the discharge is eliminated.
 - VOC will remain in high concentrations because they do not volatilize in water.
 - Since operators cannot control upstream non-point sources, they do not need to be aware of them.
 - Wastewater treatment facilities will contact the water supplier when they have an abnormal discharge.

Ans: A. SOC discharges from an industry may remain in the groundwater source long after the discharge is eliminated.



UNIT 3 EXERCISE:

True (T) or False (F)

1. ____ When the packing of a packed tower is coated with a slimy layer wash the column with a chlorine solution.

Ans. True

2. ____ Increase the air flow rate in the column when the water flow rate through the column is very low and the column is starting to flood.

Ans: False. Decrease the air flow rate in the column.

3. ____ Clean rust deposited on the packing material in a packed tower with potassium permanganate or chlorine.

Ans: False. Clean with an acid to remove the iron. Potassium permanganate or chlorine can be added in the water to avoid metals oxidizing.

4. ____ When bubbles attach themselves to the flocs and cause them to float rather than settle, decrease amount of air flow—do not over-aerate.

Ans: True

5. ____ Excess aeration has caused metal parts to corrode. To minimize this effect increase amount of air flow—over-aerate. In addition, adding a protective coating on exposed metals to minimize corrosion.

Ans: False. Decrease amount of air flow—do not over-aerate.

6. ____ To decrease risk to personnel proper ventilation and routine inspections of air handling systems is essential.

Ans: True

Calculating Feed Rate



Calculate the pounds per day of PAC to treat 3.5 MGD of water. Assume we want to feed 20 mg/L of PAC.

Ans: We calculate pounds per day by multiplying the concentration by the flow in Million gallons per day by 8.34.

$$X \text{ lbs/day} = 20 \text{ mg/L} \times 3.5 \text{ MGD} \times 8.34$$

$$X \text{ lbs/day} = 583.8 \text{ lbs/day of PAC fed}$$

More about calculating feed rates can be found in the Drinking Water Module 21: Chemical Feed.



UNIT 4 EXERCISE:

Fill in the Blank

1. Adsorption is the process of _____ a substance located in a gas or liquid at the surface of a solid.

Ans: concentrating

2. Activate carbon removes _____ and _____ through the adsorption process

Ans: taste and odor

3. Four considerations for the placement of an application point for Powered Activated Carbon are: Adequate contact time between the PAC and the _____, Coagulant will coat the surface of the PAC and _____ its ability to adsorb the contaminants, PAC will react with _____, potassium permanganate, and other oxidants and PAC is small enough to pass through a _____ filter.

Ans: organics
reduce
chlorine
dual-media

True (T) or False (F)

4. ____ The slurry system of PAC feed equipment will distribute better and prevent material from floating.

Ans: True

5. ____ A PAC uses much smaller carbon particles than a GAC.

Ans: False. The particle size of a PAC is much smaller than the larger particles of a GAC.

6. ____ A fire may start when activated carbon reacts with oxidizing agents

Ans: True

7. ____ An operator doesn't need to wear air protection around activated carbon that has been wetted down.

Ans: False. Always wear proper air protection around activated carbon. Wetted carbon, such as in the slurries, will remove oxygen from the air.

8. ____ There are four common operating problems that can occur with the adsorption process.

Ans: False. GAC has four but PAC has seven.

PAC

Carbon Dust

Improper Selection of Application Point

PAC Pass Through

Taste and Odor Problems

Poor Pre-Treatment Performance

Loss of Adsorption Capacity

GAC

Bacterial Growth

Changing Bed Depth

Desorption of Adsorbed Organics

Backwashing and Loss of Carbon

9. ____ On a regular basis a number of operation control tests can be used in the adsorption process. Core samples and effluent turbidities are done every 6-months or twice a year.

Ans: False. Core samples of carbon bed for filter absorbers should be taken every 6-months, and post-filtration contactors every 3-months. Distance between top of the carbon and top of the wash-water trough should be measured ever 3 months. The remaining control test, including the effluent turbidities should be performed on a regular basis.

10. ____ Activated carbon will burn so the following safety precautions should be taken:

- Storage area and storage bins should be fireproof.
- Dust control equipment and ventilation should be used to minimize dust.
- Carbon should not be stored with gasoline, mineral oils, vegetable oils, or similar materials.
- Carbon should not be stored with strong oxidizers.
- Explosion-proof wiring and equipment should be used in carbon storage and feed areas.

Ans: All True.